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Experiment Station Work, LXXIII.

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STILL FOR ALKALI WATER.
DRAINING WET SOILS.
MARROW CABBAGE.
BEEF CATTLE IN THE SOUTH.
POULTRY RAISING.
COST OF PRODUCING MILK.
MILK-POWDER STARTERS.
SHEEP-BRANDING PAINTS.
COOPERATION AMONG FRUIT GROWERS.

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EXPERIMENT STATION WORK.

Edited by W. H. BEAL and the Staff of Experiment Station Record.

Experiment Station Work is a subseries of brief popular bulletins compiled from the published reports of the agricultural experiment stations and kindred institutions in this and other countries. The chief object of these publications is to disseminate throughout the country information regarding experiments at the different experiment stations, and thus to acquaint farmers in a general way with the progress of agricultural investigation on its practical side. The results herein reported should for the most part be regarded as tentative and suggestive rather than conclusive. Further experiments may modify them, and experience alone can show how far they will be useful in actual practice. The work of the stations must not be depended upon to produce "rules for farming." How to apply the results of experiments to his own conditions will ever remain the problem of the individual farmer.—A. C. TRUE, Director, Office of Experiment Stations.

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ILLUSTRATIONS.

EXPERIMENT STATION WORK.[1]

STILL FOR ALKALI WATER.[2]

In a previous bulletin of this series [3] a simple form of still which can be conveniently used on the kitchen range to obtain distilled water for drinking purposes is described. This apparatus has been used to a considerable extent and has been found to serve a very useful purpose where it is difficult to secure pure drinking water from natural sources.

In a recent circular of the Montana station W. M. Cobleigh describes another form of still for this purpose which it is claimed has been found effective and convenient for household use. This still, which is designed especially for use with alkali waters, is shown in figure 1. It has the advantage of being inexpensive and can be made by any tinner.

The still consists essentially of a water boiler *A*, on the range, having a capacity of about 1½ to 2 gallons and a condenser suspended at the proper height from the ceiling.

Pipe *B*, 2½ inches in diameter, with separable joint at *I*, conveys steam to the condensing chamber *C*, which is kept cool by water in compartment *D*. The distilled water collects in *E* and can be drawn off from time to time or allowed to run continuously into vessel *F*. When the water in *D* becomes too hot for efficient condensation, it can be passed to the water tank *A* through pipe *G*, or drawn off at *H* and cold water added. When the water in *D* is cold, the still has a capacity of about 2 quarts per hour.

The metal used in the construction of the still should be well-tinned copper, and no solder should be exposed to the action of either the steam or the distilled water. If it is desirable for any reason to suspend the condenser at some distance from the kitchen range, steam pipe *B* should be wrapped with asbestos paper.

IMPORTANCE OF DRAINING WET SOILS.[4]

Briefly stated, the prime purpose of draining a soil is to increase its productive capacity by removing the surplus water. This excess of water may be caused either by direct rainfall or by seepage from land higher up. If the soil is not underlain with strata of material

[1] A progress record of experimental inquiries published without assumption of responsibility by the department for the correctness of the facts and conclusions reported by the stations.

[2] Compiled from Montana Sta. Circ. 7.

[3] U. S. Dept. Agr., Farmers' Bul. 124, p. 5.

[4] Compiled from South Carolina Sta. Bul. 167.

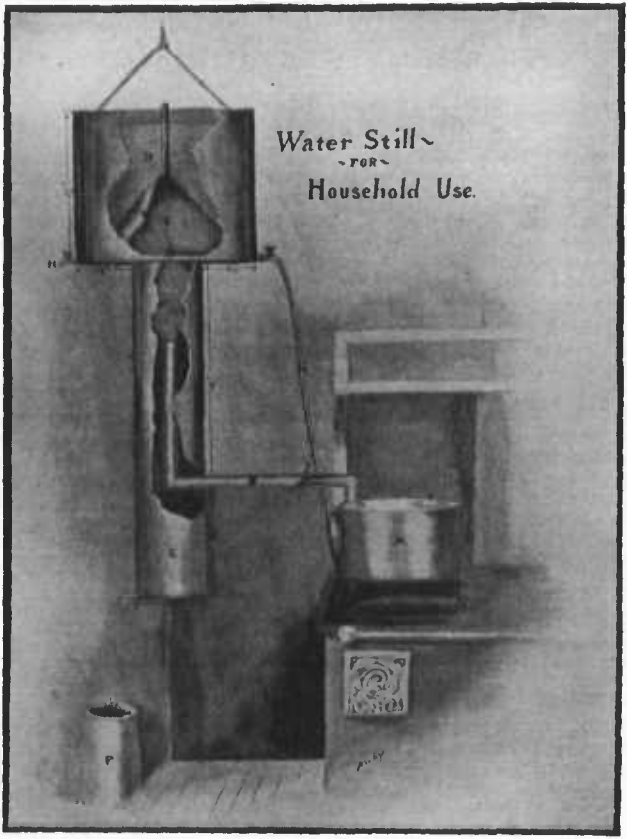

FIG. 1.—Water still for household use.

which allow this surplus water to pass off, an artificial drainage system, either by ditching or by tiling, must be installed in order to put the soil in proper condition for plant growth.

It is unfortunate that the loss in crop value incurred in the cultivation of soils which are too wet for profitable crop production is often taken as one of the contingencies of farming rather than as a loss to be prevented by the use of well located and constructed drains. A good illustration of the profitableness of draining is that of recent work by the South Carolina station in the draining of the so-called crawfish lands in the lower coastal region of the State. The drainage system in use was partly installed by the Office of Experiment Stations of this department. The results of this work show clearly that the draining of these soils is practical and exceedingly profitable. On land which before the initiation of the work of drainage was regarded as very poor and unproductive there were produced during the last two years large yields of corn, oats, cotton, and other spring crops. The work is regarded as a very important step in furthering the agricultural interests of the State.

The theory held by some people that the drainage of this land was impracticable and that even if the water could be successfully removed the land would not be productive has been entirely overthrown by the record of the past two years. There is no doubt that with the establishment of modern scientific appliances the agricultural conditions of this region may become so highly developed as to make it possible to produce a variety and wealth of crops that would compare favorably with many of the best sections in the United States.

It is the purpose of this article merely to emphasize the importance of proper drainage of the soil for profitable crop production. The judging of the need of drainage in any particular case is a problem for the individual farmer to decide. Proficiency therein can come only from a careful study of the soil and crop conditions.

MARROW CABBAGE.[1]

None of the crops tested at the western Washington station for hay, ensilage, or soiling has given greater promise than chou moellier, or marrow cabbage (fig. 2).

Marrow cabbage closely resembles kale when young, but with age the stalk enlarges until it reaches a diameter of from 3 to 6 inches or more at the largest part. It usually varies in height from 2 to 4 feet and often weighs 10 pounds or more. The pith, or marrow, which gives it its name, is frequently hollow and cracked, as seen in figure 3.

[1] Compiled from Minnesota Sta. Bul. 100; Washington Sta. Buls. 95 and 6 (spec. ser.); Agr. Gaz. N. S. Wales, 21 (1910), No. 9, pp. 793, 794; 23 (1912), No. 1, pp. 36–38; Jour. New Zeal. Dept. Agr., 4 (1912), No. 1, pp. 25, 26; Natal Agr. Jour., 15 (1910), No. 5, pp. 647, 648.

When the plants reach a height of from 18 inches to 2 feet they begin to present an appearance different from that of thousand-headed kale. By the time they are 3 feet tall the leaves have disappeared from the lower third or half of the stalk, and 5 or 10 scars mark their former location. The lower leaves mature rapidly and if not gathered some decay and fall off. Soon after they approach maturity they begin to turn a light yellow. At this stage they are readily broken from the stalk if grasped by the stem and given a slight downward pull. The break is clean and does not tear or injure the plant. In fact, the removal of mature leaves causes the plant to make a more rapid growth, and a large amount of forage is lost if this practice is not resorted to.

FIG. 2.—Marrow cabbage plant.

The stalks as well as the leaves attain a considerable size and make good feed. Figure 2 shows a plant about 4 feet tall, and greater heights are attained. The stalks of plants between 4 and 5 feet in height measure as much as 18 inches at their greatest circumference. This stalk furnishes a remarkably succulent feed. The portion which corresponds to the bark of other plants is thick and fleshy. The woody portion consists of a very thin layer near the outer edge, and the inner portion is lighter in color and furnishes a very rich, succulent, and palatable food. The stem may easily be cut off at the base.

Although no chemical analyses or scientific feeding tests are available, most reports agree that this plant furnishes large amounts of

feed, especially suitable for dairy animals and poultry, and when properly cooked the leaves are found palatable by man. It is regarded by some as superior to kale, although it is more likely to blow down and is somewhat more easily injured by frost. The lower leaves were eaten greedily by chickens and dairy cows in all the Washington station feeding tests. Stalks gathered and fed to cows were eaten greedily. No apparent bad results followed, and there was no undesirable effect observed on the quality or quantity of either milk or butter. The marrow cabbage will supply succulent feed in winter and may profitably supplement the silo. "For the poultry ranch * * * there is nothing else which furnishes green feed during both summer and winter in so convenient a form."

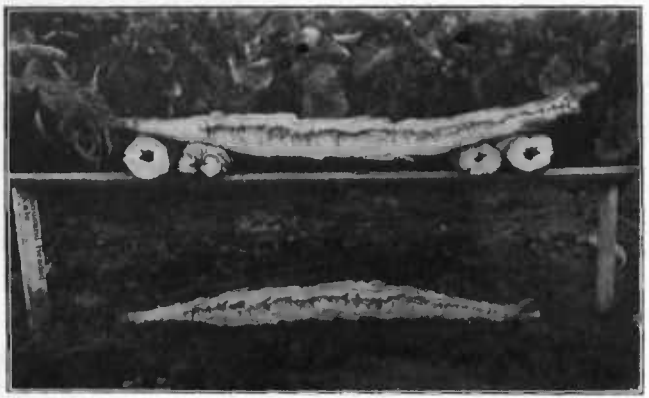

FIG. 3.—Section of stalk of marrow cabbage.

The Hawkesbury Agricultural College, of New South Wales, Australia, reports that the leaves of marrow cabbage were relished by all classes of stock. At one of the farms of this college a variety called white chou moellier proved better than any other variety tested. It was the tallest, produced the most leaf, and grew very rapidly. The stem was not woody, and practically the entire plant was edible. Another farm of this same college, however, reported that 62 per cent of the weight of the plants of this variety was refused by cattle. One experimenter reported that marrow-cabbage stalks were eaten only by pigs. The plants should be harvested before they become fully matured and woody.

The cultural and soil requirements of marrow cabbage are practically the same as those of kale. It requires a rich loam soil, but will do well on heavier soils if they are well drained and thoroughly tilled, or on light soils if they are well manured and if sufficient moisture is present. Properly drained peat soils give especially good results. At the western Washington station about equally good results were secured on light sandy loam pasture land, sandy loam soil, and black loam soil, and marrow cabbage produced about 80 tons per acre as compared with a yield of 66 tons of kale. As the plants require plenty of moisture during the hot growing season, plowing at least 8 inches deep, followed by thorough preparation, is recommended. Frequent cultivation with a spike-tooth cultivator set to run about 3 inches deep is suggested in order to save moisture and make the plant food quickly available.

The seed may be sown in a greenhouse or in cold frames about the middle of February or the first of March and set in the field as soon as ready, but these dates will, of course, vary greatly with the locality. If later plantings are desired, seed may be drilled in the field at later dates and transplanted when the plants are from 4 to 6 inches tall. When transplanted all save two or three of the top leaves should be removed. The earlier crop may be ready to strip before the middle of July.

On very rich soil where moisture conditions are good the plants should be set 2½ feet apart in rows 3 feet apart. In poorer soil they should be set 2 feet apart in rows 2½ feet apart. In transplanting on a moderately large scale a small hand machine which sets and waters the plants at one operation may be used. The water used will help the plants still more if it has been passed through a barrel of fresh manure.

Seed is sometimes planted directly in the field to be left without transplanting. It is then thinned to the proper stand, but this method is not usually followed because of the cost of the seed.

As the plant is a biennial, seed plants must be kept over one winter. They should be carefully selected before heavy freezes occur in the fall. If the land is well drained, they may be left where they grew; if not, they should be transplanted to well-drained soil. Careful selection for the purpose of fixing type and securing desirable qualities is especially desirable, because this is a relatively new hybrid. Its type is not yet fixed, and there is considerable variation in the plants. Frost resistance and size are qualities which should be kept in mind in the selection of seed plants. The branches bearing the seed pods are cut and placed on a canvas. The seed is pounded out with a stick or pitchfork and fanned out by the wind. A dozen plants will produce seed enough to plant a number of acres.

The western Washington station reports that root maggots are serious obstacles to the success of kale and marrow-cabbage culture in the western part of that State.[1]

Until marrow cabbage has been more widely tested it would probably be well for growers to test it on a small scale before making large plantings in new localities. The trials most fully discussed in this article were made at Puyallup, in western Washington, in a very moist climate.

FEEDING BEEF CATTLE IN THE SOUTH.[2]

Two important factors have heretofore served to limit the feeding of beef cattle in many parts of the South. These were the lack of suitable feeders and the impossibility of getting a good enough finish on steers with cottonseed meal and cottonseed hulls to enable the feeder to secure profitable prices in a discriminating market. The mountain regions of the South are well suited to cattle raising. These regions are furnishing large numbers of desirable feeders at present, and will doubtless meet the demand for more and better feeders as it arises. It is well known that while cottonseed hulls is a good roughage to feed in connection with cottonseed meal and other concentrates, beef cattle generally fail to make profitable gains on this ration for periods longer than 90 to 120 days. While cattle make rapid gains for this length of time they frequently go off feed and do not finish in the smooth, mellow condition of cattle fed succulent rations.

R. S. Curtis, of the North Carolina station, points out that cottonseed meal is the only commercial concentrate which at present can be profitably used for feeding beef cattle in the South.

The cattle-feeding industry furnishes a means of obtaining both the feed and fertilizer values from this commercial product, and for this reason every effort should be made to use as much cottonseed meal in the live-stock and general-farming industries as conservative business methods will permit. It has not been definitely determined just how much cottonseed meal is most profitable for feeding beef cattle, but it is likely that the concentrated portion of the ration will consist largely of cottonseed meal for an indefinite period.

Knowing, however, the approximate quantity of cottonseed meal which can be safely and satisfactorily used in a ration, Prof. Curtis conducted experiments with carload lots of western North Carolina steers for three years to determine the most suitable and profitable roughage feeds to use with the meal, comparing in these experiments cottonseed hulls and corn silage alone and corn silage and corn stover combined. These roughages were selected for comparison because

[1] See U. S. Dept. Agr., Farmers' Bul. 479, p. 5.

[2] Compiled from Mississippi Sta. Rpt. 1905, p. 11; North Carolina Sta. Buls. 218, 219, 222; South Carolina Sta. Bul. 109; Texas Sta. Bul. 153; Virginia Sta. Buls. 157, 173; U. S. Dept. Agr., Bur. Anim. Indus. Bul. 159.

they are the most available and important from the local standpoint of economy in beef production.

As beef cattle do not return large profits in the South it is necessary to confine the roughage part of the rations to the less valuable feeds produced on the farm. These experiments are based upon the fact that large quantities of corn stover are wasted annually, that corn preserved as corn silage is the most economical method for saving the crop, and that corn silage is rapidly coming into favor as a beef-cattle feed. Cottonseed hulls, though recognized as important, are becoming more expensive each year, and from the evidence obtained at this station and elsewhere they are not as satisfactory for roughage as corn stover or corn silage. It is not a judicious practice to use costly commercial feeds to replace corn silage and corn stover, which can be produced on every farm.

In the winter of 1909–10, 21 steers were fed 126 days; in 1910–11, 24 steers were fed for 116 days; and in 1911–12, 35 steers were fed for 166 days. These steers were mostly grade Shorthorns and were such as are classed as average feeders in the Southern States. The rations compared in these experiments were approximately (1) 7½ pounds of cottonseed meal daily with (*a*) 26 pounds cottonseed hulls, (*b*) 12¾ pounds corn stover and 13¾ pounds corn silage, and (*c*) 30¾ pounds corn silage; (2) 6 pounds cottonseed meal with 12¾ pounds corn stover and 13¾ pounds corn silage.

The results showed that the cattle fed on the cottonseed meal and corn silage ration not only used the meal more economically during a continuous feeding period but that they finished in better condition and commanded a higher price than cattle fed on dry roughages. The cattle fed on cottonseed hulls as the sole roughage with cottonseed meal made good daily gains for 60 to 90 days, but thereafter the rate of gain materially decreased at the expense of the proper finishing of the animal. With cottonseed meal rated at $26 to $30 per ton and hulls at $6 to $8 per ton, the cost of gain per pound with the cottonseed meal and hull ration was very high as compared with the gains ordinarily obtained in the corn belt. This is attributed to the class of steers fed as well as to the high cost of meal and hulls.

Where cottonseed meal is the only concentrate used the indications are strongly in favor of feeding beef cattle on corn silage alone for roughage or corn silage supplemented with a small amount of dry roughage, such as corn stover.

The average amount of cottonseed meal used per pound of gain was over 1 pound less with the lots fed corn silage and corn silage and corn stover combined as roughages in comparison with the lot fed cottonseed hulls for roughage. This fact is contrary to the results secured the two previous years, which showed that it took less cottonseed meal to produce a pound of gain when it was fed with cottonseed hulls.

These results are entirely in accord with conditions, however, as during the longer feeding period used the third year the silage-fed cattle continued gaining satisfactorily until the end of the period. Whereas the results show that when cottonseed hulls are fed as the sole roughage for a long period, the gains during the latter part of the period will be greatly reduced, which thus increases the amount of cottonseed meal required for making a pound of gain. * * *

The cost per hundred pounds gain was the least in case of the lot fed corn silage for roughage and the most for the lot fed cottonseed hulls for roughage, the cost for the lot fed corn stover and corn silage coming between the two. The lower cost of the gains in the lot fed corn silage and the higher value of the steers when finished made their profit more than double that of any other lot in the combined experiment. From these results the indications are that corn silage will almost replace cottonseed hulls pound for pound at practically one-half the cost for roughage.

Points of special interest which were brought out in the last experiment, covering a total feeding period of 166 days, were (1) "that the maximum safe quantity of cottonseed meal that can be fed is considerably more than the amount ordinarily thought to be the limit. (2) When a long feeding period is to be used, though cottonseed hulls will be satisfactory for the first three months or thereabouts, the use of corn silage will successfully prolong the feeding period to a time making possible prime fitting of cattle for a discriminating market." However, the cottonseed meal should be used in smaller amounts at the beginning of the feeding and gradually increased. "The cottonseed-meal part of the ration should not be increased on the average more than 2 pounds per animal per week. By feeding 1 pound of meal per steer for the first few days and then increasing it at the above rate, the steers will be on a full ration of 7 to 8 pounds about the end of the fifth week."

Summarizing the results and conclusions of the North Carolina experiments it appears that—

Two important problems confront the southern beef-cattle feeder. First, the difficulty of getting steers in prime condition on cottonseed meal for a discriminating market, and, second, the difficulty of obtaining a margin sufficient to balance the extra cost of fattening when they are put in high condition. The former trouble may be met by using other concentrates than cottonseed meal, either at the beginning or end of the feeding period, to offset the apparent toxic effect of the meal, especially when it is fed for long periods with dry roughages. Unfortunately, however, the feeds other than cottonseed meal which may be used for fattening cattle while putting them in prime condition so increase the cost of production that this method can not be used by the practical feeder. The only practical and effective method so far demonstrated of finishing cottonseed-meal-fed steers in prime condition is by the use of liberal quantities of corn silage which has some specific effect in deferring the apparent toxicity and in obtaining the greatest efficiency from cottonseed meal. * * * The fact that a succulent feed like corn silage will materially increase the value of cottonseed meal to beef-cattle feeders should place the South in line for the production of a large part of the eastern supply of beef. This is now almost wholly shipped in from the Middle West and Southwestern States, because the South has never produced the quantity to supply the demands of the more discriminating buyers. Cottonseed meal and corn silage with possibly some dry roughage will no doubt give more economical results than any other feeds which may be used for fattening beef cattle.

E. R. Lloyd, of the Mississippi station, compared cottonseed hulls with corn silage for beef production and found that six steers in 45 days made a total gain of 451 pounds and consumed 240 pounds

of silage, 1,482 pounds of cottonseed hulls, 1,350 pounds of hay, and 1,752 pounds of cottonseed meal and corn chops. A similar lot fed the silage ration gained 570 pounds in 45 days and consumed 2,973 pounds of silage, 240 pounds of cottonseed hulls, and the same quantities of the other feeds as the first-mentioned lot. In this test 1 pound of cottonseed hulls was equal to 1.58 pounds of silage.

At the Virginia station in 1904–5, A. M. Soule and J. R. Fain fed six lots made up of five steers and five heifers each for 180 days for the purpose of testing corn silage, corn stover, and timothy hay when fed in connection with cottonseed meal and corn-and-cob meal and with linseed meal and corn-and-cob meal. The silage-fed cattle made an average gain of 1.46 pounds, the stover-fed cattle 0.97 pound, and the hay-fed cattle 1.10 pounds per head per day.

The silage-fed cattle made much larger gains, showed more quality at the end of the feeding trial, and in any discriminating market would have brought a considerably higher price than the other animals.

It has generally been held that silage-fed cattle lose very materially in live weight when shipped long distances. In 1906–7 the Virginia station found that cattle fed corn and cottonseed meal with silage as the principal form of roughage lost 41.2 pounds per head in being shipped to Jersey City. It is stated that practical shippers and handlers in Virginia figure the average shrinkage to Jersey City at from 60 to 70 pounds.

There does not seem to be any justification, therefore, for claiming that silage-fed cattle will drift [shrink] more than cattle fed in other ways. When these cattle were sent to Jersey City a representative of the station who accompanied them found the buyers much prejudiced against cattle from the South, stating that they did not kill out well, and that the meat was of a dark color and the bone very hard. Though these cattle presented as good an appearance as many of the corn-fed animals shipped in from the West and on sale at the same time, the buyers persisted in discriminating against them because of the belief that silage-fed cattle would not kill out advantageously or make a first-class quality of beef. The cattle followed through the slaughter pens, however, killed out as well as, and in many instances better than, the corn-fed cattle from the West; and the meat was of superior quality, the fat and lean being better blended and the color particularly good. This lot of cattle dressed out 56.9 per cent, which is very creditable, considering that they were ordinary grades and fed but for 150 days on a ration which has been regarded as eminently unsatisfactory for feeding beef cattle to a finish. These figures seem amply to justify the claim that silage is a most satisfactory roughness for beef cattle, and that animals fed on it will ship well, kill well, and produce meat of fine quality. These conclusions seem justified even in the face of competition with western corn-fed cattle. The efficiency of silage as a valuable feed for southern stockmen when fed under the conditions prevailing in this test needs no further vindication in the light of the facts here set forth, and should do much to encourage the production of beef in sections where the natural conditions by reason of the insufficiency of grass are supposed to be a barrier to this phase of animal industry.

In an experiment conducted by the Alabama station in cooperation with the Bureau of Animal Industry of this department, 60 grade

Hereford, Aberdeen-Angus, and Shorthorn steers from 2 to 3 years old were fed for 66 days during the winter of 1909–10. During the first 28 days each lot received a daily ration of 4.64 pounds of cottonseed meal per head, which was increased to 6 pounds for the next 28 days and to 7.73 pounds thereafter. In addition all lots were fed cottonseed hulls and lot 2 Johnson-grass hay during the whole period, and for the first 56 days lot 1 was fed corn silage. The average daily gain per head for the silage-fed steers was 1.86 pounds, which was made at a cost of 7.98 cents and a consumption of 2.87 pounds of cottonseed meal per pound of gain. The lot fed Johnson-grass hay gained 1.43 pounds each daily at a cost of 11.88 cents and a consumption of 3.72 pounds of cottonseed meal per pound of gain. The lot fed cottonseed meal and hulls gained 1.89 pounds each daily at a cost of 8.8 cents and a consumption of 2.8 pounds of cottonseed meal per pound of gain.

Commenting on this experiment it is stated that—

> Ton for ton, silage was just three times as valuable as Johnson-grass hay when they were both used along with cottonseed meal and hulls for fattening cattle. Johnson-grass hay proved to be a poor feed for fattening purposes, while silage had an exceedingly high value when used for the same purpose. The cattle feeder can not, therefore, afford to use Johnson-grass hay along with cottonseed meal and hulls for fattening purposes, and this experiment tends to show that the majority of southern feeders can not use a more economical feed than silage for this purpose.

The Texas station reports a cooperative feeding test made during the winter of 1911–12 under actual farm conditions with 40 head of range-bred 3 and 4 year old grade Shorthorn and Hereford steers. These steers averaged 904 pounds at the beginning of the experiment. The feeds used were cottonseed meal, cottonseed hulls, mixed sorghum and Johnson-grass hay, and silage. The silage was about 75 per cent milo maize, 15 per cent corn, and 10 per cent sorghum. Lot 1, 15 steers, was fed cottonseed meal and hulls, and lot 2, 25 steers, cottonseed meal, silage, and, during a part of the experiment, hay. The test lasted 119 days. Cottonseed meal was fed at the rate of 3 pounds daily per steer, this amount being gradually increased to 6 pounds at the end of the first month and to 7 pounds at the beginning of the third month. It was thought that better results would have been secured if less meal had been fed. Bad effects, however, were noticed only in lot 1. The steers in lot 1 were started on about 20 pounds of hulls daily, which was soon increased to all they desired. Those in lot 2 received about 25 pounds of silage at the beginning, which was soon increased to about 50 pounds, which was all they would eat. At the end of the first month hay was added to the rations of this lot, and about 4 pounds daily per steer was eaten. The steers in lot 1 gained 1.98 pounds each daily at a cost of 10.04 cents and a consumption of 3.02 pounds of meal per pound of gain. Those in lot 2

gained 2.03 pounds each daily at a cost of 7.32 cents and a consumption of 2.96 pounds of meal per pound of gain. Preparatory to shipping to Kansas City all the steers were fed liberally for one day on corn shucks. The loss in weight during shipping was 84 pounds each for the steers in lot 1 and 83 pounds each for the steers in lot 2. The silage-fed steers brought 20 cents per hundredweight more than the hull-fed steers. There was a net profit of $10.40 a head on the steers in lot 2 as compared with 67 cents a head on the steers in lot 1.

The results of this experiment seem to indicate that a ration of cottonseed meal and silage may be used far more profitably than a ration of cottonseed meal and cottonseed hulls for fattening cattle. * * *

Silage was a much cheaper feed than cottonseed hulls and yielded slightly larger gains.

There was practically no difference in the shrinkage of the two lots of steers in shipping.

There was practically no difference in the dressing percentage of the two lots.

A. Smith, of the South Carolina station, has recently reported a feeding experiment, the object of which was to determine the relative value of cottonseed hulls, corn stover, and corn silage as roughage for beef cattle when fed with cottonseed meal. Sixty North Carolina steers averaging 890 pounds were used in the experiment. The steers were divided into 3 lots and fed 102 days in open sheds. They were well bedded and had access to water at all times. Each lot received the same amount of cottonseed meal, which was at the beginning one-half pound per 100 pounds live weight and increased to 5 pounds per steer daily at the end of the second week, and gradually to 7 pounds for the second month and to 8 pounds for the last 40 days. In addition, lot 1 was fed from 35 to 45 pounds corn silage per steer daily, lot 2 cottonseed hulls equal in weight to the meal fed and from 15 to 20 pounds corn stover, and lot 3 from 24 to 26 pounds cottonseed hulls. Lot 1 made a daily gain of 2.18 pounds each, at a cost of 6.4 cents; lot 2, a gain of 1.54 pounds, at a cost of 9.82 cents; and lot 3, a gain of 1.5 pounds, at a cost of 11.9 cents per pound, cottonseed meal being charged at $24, cottonseed hulls at $7, corn stover at $5, and silage at $3 per ton.

It is stated that the high price of hay prevents its being fed profitably to beef cattle in South Carolina.

There are practically only three kinds of roughage available at a reasonable cost—cottonseed hulls, stover, and silage. While cottonseed meal is the cheapest concentrate that is on the market for cattle, many farmers find it difficult to break away from the established custom of buying hulls to mix with the meal for roughage. It is important to note that the hulls required for lot 3 (fed on meal and hulls) cost $19 more than the meal. When the difference in the feeding and fertilizer value of the meal and hulls is considered, it will be readily seen that any method of feeding that will reduce the cost of roughage will materially increase the profit of feeding beef cattle.

The results of the South Carolina station experiments "indicate clearly that corn silage and stover are equally as valuable as hulls for feeding beef cattle and much more profitable to feed."

In deciding what kind of roughage is most profitable for beef cattle, it is interesting to note the difference in the margin of profit required in the three lots of cattle to cover the cost of feed and freight. The silage-fed cattle required a margin of only a fraction over one-half cent per pound (0.59 cent). The stover-fed cattle required a margin of 1 cent per pound, and the hull-fed cattle required a margin of 1¼ cents per pound.

With good silage and cottenseed meal at a reasonable price, the opportunities for feeding beef cattle profitably are unexcelled in any other section of the country.

One of the most important factors for the farmer to consider is the value of the manure obtained from the cattle. The 60 cattle used in the South Carolina experiments produced 172 tons of manure in 102 days. The fertilizing value of this manure was nearly three-fourths that of the feed consumed and exceeded $3 per ton. The high value of this manure shows "the necessity and advantages of feeding the cattle under conditions that will prevent unnecessary loss when the cattle are not fed in the fields where the manure is required."

TOWN AND COUNTRY POULTRY RAISING.[1]

Discussing this subject, J. S. Jeffery, of the North Carolina station, says:

The great bulk of the poultry raised throughout the country is raised on farms where it is only a small part of the investment. Poultry raising, however, under proper conditions, is one of the most profitable of the small industries. Statistics gathered in one county of New York State showed that for the money invested poultry was more profitable even than the dairy cow.

The farmer has a great advantage over the town poultryman in having abundant range for his stock where it should be able to get plenty of green feed and insects. Many farmers do not get as much advantage as they should from their conditions on account of a fear that the fowls will injure the growing crop.

Unless portable houses are used so that the fowls can be moved to suit the crops and conditions, it will be advisable generally to have a yard in which the flock may be confined when necessary. If portable houses are used, yards will not be necessary. Fowls ranging on a grain crop just coming up will kill out a great deal of it, while if kept off for a month or two till the young plants get a good start, they will not injure the crop if precautions are taken to prevent large numbers ranging on a small area.

Twenty hens to the acre may be pastured on a wheat or oat crop with no apparent injury to the crop if they are spread out in small colonies.

If 200 were housed in one house with a range over a 10-acre field they would cause much greater loss.

The scattering of the flock in small colonies increases somewhat the labor of caring for them. The hopper method of feeding[2] is almost a necessity if the flock is kept in this way.

[1] Compiled from North Carolina Sta. Bul. 221.

[2] Feed hoppers recommended by the New York Cornell experiment station are described in U. S. Dept. Agr., Farmers' Bul. 316, p. 30.

The greatest objection to this method is the difficulty of controlling any disease which may break out. In cases of this kind it is often necessary to confine the flock in yards for a time.

The farmer often suffers loss with his chicks because he has fallen into the habit of raising them year after year in the same place without taking any precautions to purify the ground between seasons. If only one place is available, this may be kept in fairly good condition by the use of lime and by plowing and cropping between seasons. Even when cared for in the best possible manner, it is not as desirable as new ground or ground that has been used a season or two for growing crops.

The conditions and problems of the poultryman living in the city are somewhat different from those on the farm. In the city the poultryman is confined in most cases to comparatively small quarters and does not have the same chance to move his poultry to fresh ground that the farmer has. Under these conditions it is even more necessary to keep what land one has in good condition. If a garden is also wanted, the land available might be divided into two lots, placing the house so that the fowls may be turned into either lot at will. This will give a chance to alternate the ground between the garden and the poultry, which will be of advantage to both.

The man living in town does not have the advantage of range for his fowls, but as he usually keeps only a small number the waste from the kitchen can be made to help out with the feeding. In many cases these waste products are warmed regularly for the poultry and mixed with corn meal and wheat bran. Where the flock is small this does not entail enough labor to make it unprofitable, as might be the case if conducted on a larger scale.

In many cases the town man succeeding with a small flock makes the mistake of increasing his flock beyond the capacity of his yards. With the larger flock the kitchen waste forms such a small part of the feed as to be hardly noticeable, and he finds that his larger flock is not nearly so profitable as was the smaller one.

It is quite common to find persons starting in a new place making a marked success at first and gradually doing poorer and poorer till complete failure is reached, simply because the yards have been overstocked and not kept in a sanitary condition.

COST OF PRODUCING MILK.[1]

The increased cost of feed and labor and the rise in price of good cows without a corresponding increase in the price of milk gives special significance to any accurate data bearing upon the actual cost of milk production. Such data are furnished by records given in a report of the New Jersey experiment stations, of 31 head of milch cows, mostly grade Holsteins, Jerseys, Guernseys, and Ayrshires, fed both home-grown and purchased feeds, the calculations of cost of production being based both on the actual cost of growing the crops fed and on the market prices of the products used. The feeds used included soiling crops of different kinds, corn silage, mixed hay, oat and pea hay, alfalfa hay, corn stover, beet pulp, distillers' grains, wheat bran, and oil meal. The average cost of feed per cow per year (based on actual cost of producing the crops used) was $95.73 or 2.4 cents per quart of milk produced. Placing the market valuation upon the home-grown products, the cost of feed per cow per year was $121.60, or 3.04 cents per quart. The

[1] Compiled from New Jersey Stas. Rpt. 1910, pp. 51–76.

estimated average cost of labor (but not supervision) and incidental expenses was $70.22 per cow per year, or 1.76 cents per quart. The incidental expenses include bedding, stabling ($5 per cow), interest on investment in animals, depreciation in value of cows, keep of bull, etc., but not interest on land, buildings, and dairy equipment.

Based on actual cost of growing and harvesting products consumed and of labor, the total cost for feed, labor, etc., for the year was per cow $165.95; based on market valuation of feed consumed, $191.82. The yield of 31 cows averaging 8,661 pounds of 3.96 per cent milk, the total cost per quart of milk will be in the first case 4.16 cents, in the second case 4.8 cents. No credit, however, is given the cow for the manure voided or the calf produced, neither is the farmer's time charged for. Calculating the manure worth $20 per cow, and the grade calves $6 each at 5 days old, the cost of producing 4 per cent milk even with the high yields reported, and not including cost of supervision, was approximately 4 cents per quart.

For a fuller discussion of this subject the reader is referred to an article summarizing the results of similar observations at a number of experiment stations in an earlier bulletin of this series.[1]

MILK-POWDER STARTERS IN CREAMERIES.[2]

Messrs. Larsen and White of the South Dakota station report a study of the relative value of milk-powder starters as compared with natural-milk starters. As the authors point out, milk powder has its value for starter making wherever the location of the creamery plant is such that an ample supply of good milk can not be obtained at the usual price. This is often the case in large cities, and it is believed, therefore, that milk powder has a special value under such conditions, for it has been often demonstrated by experiments that a good starter properly used in cream in connection with the manufacture of butter improves the uniformity, quality, and keeping properties of the butter.

In comparative tests reported by the authors the butter made from cream ripened with milk-powder starter scored on an average 0.042 points higher and showed an acidity 0.015 cubic centimeters less than the butter made from cream ripened with natural-milk starter.

A study of the degree of concentration that would supply the best conditions for bacterial growth showed that 3 ounces of milk powder to 1 quart of pure water are the proportions which gave the best results under the conditions of the experiment. The milk powder can be easily kept without deterioration, as was shown by the fact that two drums of this material remained in good condition in a room adjacent to the creamery for over a year at ordinary room temperature.

The milk powder should be dissolved in pure warm water, preferably clean distilled water. Pure well water also gives good results. Add powder to water rather than water to powder to get the quickest solution.

[1] U. S. Dept. Agr., Farmers' Bul. 480, p. 10.

[2] Compiled from South Dakota Sta. Bul. 123.

The cost of skim-milk powder is 16 cents per pound. When it is dissolved in water in proportions given above, the cost is 11 cents per gallon and $1.32 per hundred pounds.

The advantages of skim-milk powder for starters in creameries are that a large supply may be secured at one time, it is always on hand when needed and always fresh, and is not bulky to store and to transport.

The chief disadvantages of milk powder for starters are the cost and some additional work in preparing the starters.

SHEEP-BRANDING PAINTS.[1]

As C. J. Oviatt, of the Wyoming station, points out, a suitable sheep-branding paint is a matter of considerable importance on the western ranges. "Under range conditions a permanent brand is an absolute necessity, not only in determining the ownership of stray animals, but also in the customary breeding operations. An indistinct brand ofttimes means much trouble and loss." Range conditions "are exceedingly severe upon paint brands, and experience teaches that but few will last the season."

It is also imperative that the brand be of such material that it will scour readily. Every drop of paint placed upon wool must be removed before the wool can be manufactured into cloth. If the brand will not scour out by the usual methods, then hand labor must be employed to go over every fleece and clip off the brands. This not only means the loss of the wool clipped off, but it means a considerable amount of money expended for labor, all of which eventually comes out of the pockets of the woolgrower. * * *

In the big woolen mills the manufacturer of cloth takes no chances with paint brands. The fleeces are worked over by hand labor and the brands clipped off. Brands that will scour and brands that will not are treated alike. This is an exceedingly costly operation and is necessitated only by the too liberal use of undesirable paints. If all woolgrowers would use a scourable paint the labor would be eliminated and the saving could be added to the price of wool. * * *

In some localities a brand placed upon the ear, nose, or forehead where it would not injure the wool would be sufficient. In fact, in many cases the entire absence of a brand would serve as the best identification mark. It is the duty of the woolgrower to use as little paint as possible, placed where it will be the least injurious to the fleece. When the sheepmen appreciate the decreased price of wool due to extravagant use of paint, they will exercise more care in the selection and application of their brands.

A perfect branding fluid must have two main characteristics: (1) It must be permanent enough to withstand range conditions for one year and show with reasonable plainness at the end of that time; and (2) its composition must be such that it can be completely removed by ordinary scouring solutions.

Tests made at the Wyoming station to ascertain the comparative efficiency, durability, and scouring-out qualities of various sheep-branding paints showed that the paints remained longer on downs and fine wools but the fineness of the wool had no effect upon the scouring-out qualities. Certain of the market paints gave good

[1] Compiled from Wyoming Sta. Bul. 93; Rpt. 1912, p. 14.

results, but a paint made of Venetian red or lampblack mixed with linseed oil and thinned to the right consistency with turpentine was much more durable than these, although it did not scour out well.

COOPERATION AMONG FRUIT GROWERS.[1]

Developing methods of production and distribution of agricultural products along purely economic lines is of comparatively recent origin, more attention having been given possibly to the side of production. However important it may be to be able to grow crops in large quantities or of particular qualities at a minimum cost, it is equally important to be able to dispose of them in the most economical way and to the best possible advantage, for frequently the easiest and largest profits in any business are those made through methods of handling, marketing, and distribution; and it is here that judgment based upon economic principles must be exercised and careful dealing resorted to if the highest returns are to be realized.

A common method of disposing of the crop is by selling directly to retailers, which has proved successful in some instances by choosing only one dealer in a place and putting nothing but first-class material on the market. The most usual method of disposing of fruit crops, as contrasted with selling other farm products, is through commission merchants. This arrangement, however, has not proved entirely satisfactory, the reasons for which are attributed partly to the system, partly to the middleman, and partly to the producer, the middleman always looking out for his individual interest, taking advantage frequently of the producer's ignorance of marketing and market conditions, while the producer in many instances performs his part of the transaction in a careless, indifferent, or haphazard way. The business is conducted on the plan that if there is any profit it belongs to the commission man; and if any loss, it goes to the producer. This frequently invites dishonesty, and much swindling has brought the commission men as a class into disfavor and sometimes unjustly.

Selling through cooperative associations, which is more largely practiced by the fruit growers of the West than any other section of the United States, has proven successful just in proportion as the members have followed the rules, regulations, and instructions of such associations, which in many cases has been done with very gratifying results. In addition to returning profits to the producer, which formerly went to a number of middlemen, cooperation has taught the grower the economic value of a first-class product; the economic importance of picking, packing, and handling his produce; and fair dealing with the purchaser and public.

[1] Compiled from Missouri Sta. Bul. 97; Oregon Sta. Bul. 94; Ontario Dept. Agr. Bul. 192. For a previous article on cooperation in marketing fruit and truck crops see U. S. Dept. Agr. Farmers' Bul. 309, p. 30.

W. H. Chandler, of the Missouri Experiment Station, who has secured information from quite a large number of cooperative associations regarding their methods of distribution and marketing fruit, points out that the growth of the cooperative movement among fruit growers in the United States has been very rapid during the past 10 years, even surpassing the expectation of the most sanguine and best-informed men interested in the fruit business. A number of failures among the organizations, however, are reported.

From the reports of a number of successful associations submitted to the station it is shown that cooperation enables growers to make use of a number of better business methods: (1) By enabling them, through their manager or representative, to meet on equal terms the men with whom they deal. Their representative, thoroughly understanding the markets, "with all the growers and a good pack behind him controls a business that demands respect, and he should generally be able to set the price." It must be remembered, however, that cooperation is not for the purpose of creating a monopoly or forcing unnatural prices for the product. (2) It frequently brings about or forces track selling, which in the opinion of some brings better results than consigning, one association reporting that for 272 cars consigned it received an average of $1 per crate and for 288 cars sold on track $1.66 per crate. (3) Wholesale dealing is made possible, not only in selling farm products but in buying anything the grower needs, especially packing materials, spraying materials, fertilizers, and the like. (4) Because of the larger business it controls the association is likely to get better service from the railroads, cold-storage plants, etc. "Then it is in a position to secure adjustments with the railroads and other large concerns on points of disagreement, when the cost of litigation would make such adjustments impossible with the small grower." (5) Men of better business ability than the average grower can be secured to manage the association, which means much in the economic disposition of a fruit crop or most any other crop, for many of the best growers, who understand their trees and the methods of care the best, are not the best adapted to deal with men and markets and market conditions.

Cooperation further enables growers to make use of fruits grown in small quantities, which are often wasted because no man has enough to sell to advantage. With cooperation a car could often be loaded and the fruit used to some advantage to each grower, carload lots being considered the economic unit of shipment. It secures better equipment for handling a crop in a section, as disorganized sections are less likely to have the necessary cold-storage, precooling, and other equipment for the best handling of a fruit crop. In addition to the benefits of cooperation already mentioned, Mr. Chandler notes the following: (1) The crop may be distributed so as to pre-

vent gluts in the market; (2) it enables the growers to establish a brand that will be known in the markets and will thus insure better prices; (3) it insures better care of the orchards; and (4) in nearly all cases it results in greater stability of the industry.

Among the difficulties in the way of cooperation are:

(1) The fact that independent growers who do not help support the association get many of the benefits received by the members without paying for them. This will be evident when it is considered that one of the greatest functions of cooperation is proper distribution; and if the association keeps fruit, for example, out of the way, there is little danger of the independent grower's fruit going into a glutted market; consequently he will get nearly as good, if not as good, prices as members. This being true, independent growers will be slow to join the association, and members seeing independents doing as well as they, without having to pay their share toward the support of the association, may tend to drop out.

(2) The difficulty of keeping the quality of the goods handled by the association as high as the quality of goods that would be handled by the best growers working independently.

(3) Crop failures that get the association out of working order on off years.

(4) A spirit of envy and lack of confidence and support of the managers by the members.

Another impediment in the growth of cooperation which might have been noted is the difficulty of securing funds to finance the production and marketing of the crop in the way prescribed by the association. However, it is possible to meet this difficulty by carrying the principle of cooperation a step further and securing loans through a system of cooperative credit, which has done much for European farmers toward solving economic problems of the farm and community. Mr. Charles Douglas,[1] of Scotland, as quoted in a bulletin of the Missouri station, says:

> The greatest practical obstacle in the way of agricultural organization is generally the difficulty of finance. A very large number of those who might benefit most by cooperation are prevented from taking advantage of it because they deal on long credit with the merchants who supply them. It is this fact which has chiefly led to the development of cooperative credit as an essential adjunct to cooperative purchase. * * *
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> The fundamental idea of the Raffeisen banks, which are the general model for cooperative credit in agriculture, is that the farmers in a small area should combine to find credit for one another. They provide loans for approved reproductive purposes; and the banks rely for their success on the knowledge which their members and managers have of local circumstances and of the character of the applicants, as well as on the fact that each member, being implicated with every transaction, has an interest in seeing that loans are only made for suitable purposes and to reliable

[1] Trans. Highland and Agr. Soc. Scotland, 5. ser., 22 (1910), p. 9.

persons. It is an interesting corroboration of the soundness of this principle that these banks do not in practice have any bad debts. Both in Germany and in Italy the banks are closely associated with purchasing societies, so that the borrower has the advantage not only of credit on reasonable terms, but also of cooperative purchase and of the advice and guidance of those by whom the loan is sanctioned.

Regarding the secondary results brought about by cooperative action, it may be said that they are several in number and decidedly far reaching in their effects. Increased crops and increased prices spell, of course, larger incomes and larger profits, the influence of which stimulates and revives rural life on its social no less than on its economic side. Public schools, country churches, other public institutions, and general rural life are apparently made better, all of which tends to check the drift of rural population to towns and cities.

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